

AN ACCOUNT OF SOME FRESH WATER CILIATES FROM LAHORE

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(With two plates)

Before undertaking the description of the various forms a few words about the Ciliates in general will not be about of place.

The Ciliates are the most abundant and familiar of microscopic forms of life. They derive their popular name ciliate on account of the presence of small vibratile locomotary appendages called cilia. They are also called Infusoria, a term which was generally used to denote the various microscopic organisms which make their appearance in infusions exposed to air, but now the limits of the term have been narrowed down to denote Ciliata and Suctorio only.

They are mostly free-living aquatic forms, both marine and fresh water, but a large number of parasitic forms are also known to occur in the digestive tract of man, mammals and other vertebrata.

They are considered to be the highest of Protozoa, because in no other class namely Rhizopoda (amœba-like) Flagellata, or Sporozoa, does the cell-body attain so great a complication of parts, or so high a degree of structural differentiation. Unlike the above-named three classes, the Ciliata possess a well-developed mouth, sometimes a gullet also, an anus; quite often organs of offence and defence, nuclei typically two in number: macronucleus and micronucleus, besides cilia the typical organs of locomotion which are again modified into simple cilia, cirri, membranellæ, and undulating membranes according as to the use they are put to, viz., cilia for swimming, cirri for creeping on the mud at the bottom of pools, and membranellæ and undulating membranes for assisting in prehension of food.

The present paper is based on the examination of samples of water from various localities in the near vicinity of Lahore. Several ponds, ditches, artificial small ponds (*chabacha*), small pools on the banks of the River Ravi, and the Chota Ravi, and the bed of the drying up canal-water course, were occasionally visited at different hours of the day for making such collections. Samples of running water were also often examined.

The observations were carried on during a period of ten months from June 1923 to April 1924, i. e., to include the physical conditions of the above-named localities, during the hottest, the rainy and the coldest months of the year. The bottom collections were always seen to be full of Protozoan life. The surface water, when covered over with whitish or green vegetable scum also showed a great number of these organisms.

The special features of the localities visited were that the ponds were covered over with a thick scum of duck-weed; the ditches and artificial small ponds had putrifying dry leaves in them, and only those small pools on the banks of the river were selected for taking samples of water which had a thick whitish scum over the surface, for the reason that the thicker the scum, the larger was the number of organisms found in it.

The ciliate Protozoa were seen to live in association with flagellate Protozoa and Rotifers in the surface collections and the bottom collections showed the presence of several Nematode larvæ and other Oligocheata.

Ciliates of the genera. *Holophrya*, *Spathidium*, *Lacrymaria*, *Coleps*, *Didinium*, *Dileptus*, *Loxophyllum*, *Nassula*, *Chilodon*, *Glaucoma*, *Colpidium*, *Colpoda*, *Urocentrum*, *Cyclidium*, *Sigmastomum*, g.n., *Telotrochidium*, *Halteria*, *Urostyla*, *Pleurotricha* and *Gastrostyla* were found; some of the species being new and others being described for the first time in India.

The only recent work on the fresh-water protozoan fauna of India is that by Professor B. L. Bhatia, and Professor E. N. Ghosh of Calcutta Medical College. I have referred to the former's papers, being unable to get hold of

Professor Ghosh's papers some of which have been published in comparatively little-known local journals, I have simply referred to the brief notes about his papers in the abstracts in the *Journal of the Royal Microscopical Society*. The only previous work worth mentioning is that of J. H. Carter, who studied these forms in Bombay towards the middle of the last century, and published a number of papers in the *Annals and Magazine of Natural History*. I could not refer to these papers, but I got the list of forms recorded by him from the table given in Professor Bhatia's papers. I have followed Schewiakoff's classification of these organisms as given by Hickson in Lankester's system. For specific diagnosis I have referred to Saville Kent's *Manual of the Infusoria* and Eyferth's *Einfachste Lebensformen* and *Fresh-water Biology* by Ward and Whiple. Various other papers the loan of which I obtained from Professor B. L. Bhatia, and others that I was able to consult in from various journals, are arranged in alphabetical order in the reference list given at the end.

I wish to take this opportunity of expressing my indebtedness to Professor B. Bhatia for his valuable guidance.

Order—HOLOTRICHA.

Sub-order—GYMNOSTOMATA.

Family—HOLOPHRYINA Party.

Genus—*Holophrya* Ehren.

Holophrya simplex Schewiakoff. (Plate I, fig. 1.)

Body 52×39 mic., oval, cylindrical, a little less than one and a half times as long as broad. Entirely ciliate, cilia small, and close set. Body full of vegetable matter, so details of internal structure could not be seen in the living specimens. Oral aperture at the anterior end, not projecting; pharynx absent. Contractile vacuole single, subcentral. Macronucleus oval in shape, situated in the middle of the body; micronucleus, a small round structure, lying near the periphery. Habitat: stagnant water covered over with thick green scum; surface sample.

A few specimens of this species, as defined above were found in a temporary collection of water in a ditch on the road-side in front of the Biological Laboratory, Government College, Lahore, on the 25th January 1924, at about 9 a.m. It was only occasionally that specimens of this species were found in collections from this water. The arrangement of cilia in longitudinal striæ could not be made out on account of their being full of vegetable matter. Only one contractile vacuole was seen. No feeding vacuoles were seen, due probably also to the dark appearance of the body. There were no trichocysts. The shape of macronucleus described in this species is globular, but in the specimens obtained by me the shape is ovoidal. They correspond with the description given in Eyferth in all other respects.

This species is being recorded for the first time in India.

Genus—*Spathidium* Dujard.

Spathidium spathula O. F. Muller, var. *moniliforme* B. L. Bhatia. (Plate I, fig. 2.)

Body 112×85 mic.; flask-shaped, neck of the flask being extremely small; flexible; anterior end narrower than the middle of the body; width increases posteriorly, the posterior end being broadly rounded. Mouth occupies almost completely the narrow anterior end. The margins of the oral portion are padded. The general surface of the body appears to be striate. The ciliation is uniform except that the cilia round the anterior end are slightly longer. The movements of the animal are slow. Contractile vacuole is poster-terminal. Macronucleus consists of a long chain of small beads. Length is one and a half times as long as the width. It differs from the description given by Professor B. L. Bhatia in the proportion of length to width, the width noted by him being only 20 mic. against 105 mic. of its length, while in the specimens obtained by me length is only $1\frac{1}{2}$ times as long as broad. Only

a few specimens were obtained so the measurements have not been considered as a specific character.

Habitat : Stagnant water from a drain in February.

Genus—*Lacrymaria* Ehren.

Lacrymaria striata sp. novo. (Plate I, fig. 3.)

Body 90×43 mic. ; elongated ; ellipsoidal in shape ; anterior end shaped like the cork of a bottle, and surrounded by a ring of cilia ; the body tapers to a narrow posterior end, which is completely occupied by the contractile vacuoles. Greatest width lies in front of the middle. Mouth at the anterior tip without any gullet. The whole of the body has a dark brown appearance except at the two ends, where it is transparent. Striations are both longitudinal and transverse. The anterior end is separated from the rest of the body by a constriction. Locomotion is not very swift. It has a calm, gliding movement, rotating round its axis. Length is twice as much as the breadth. Macronucleus oval, lies a little below the middle of the body. Micronucleus small, and round, lies about the middle of the body, a little in front of the macronucleus.

Habitat : From the stagnant water of a drain. The specimens encountered differ from all other known species of the genus as regards the general form of the body ; of the longitudinal and transverse striations of the cuticle ; and the contractile vacuole, which occupies the whole of the posterior end. The name *L. striata* is suggested. Specimens obtained were few.

Family—*COLEPINA* Ehren.

Genus—*Coleps* Nitzsch.

Coleps hirtus O. F. Muller. (Plate I, fig. 4.)

Body 52×24 mic., ovate, sub-cylindrical, more or less barrel-shaped ; persistent in form ; about twice as long as broad. Anterior margin denticulate ; three spinous processes developed at the posterior extremity ; cuticular surface usually longitudinally and transversely furrowed, and thus divided into quadrangular areas. Ciliated all round, cilia round the oral aperture are slightly larger than those on the general body surface. Anal apertures are situated at the anterior and posterior ends respectively. Macronucleus is spherical and central in position. Contractile vacuole is single, and is situated posteriorly. Brisk movement ; rotates vigorously on its own axis, when it wants to throw out excreta. The colour of the animal is dark brown.

Habitat : Pond water among duckweed and algæ, more generally at the bottom. From a small pond near Data Ganj Bakhsh.

Family—*CYCLODINA* Stein.

Genus—*Didinium* Stein.

Didinium nasutum Stein. (Plate I, fig. 5.)

Free-swimming animal-cules ; body 102×40 mic., ovate, or sub-cylindrical, about one and a half times as long as broad, the anterior border produced into a snout-like process ; it is a protrusible, tubular projection, at the distal extremity of which is the oral aperture. Cilia restricted to two girdles, subservient merely to the purpose of locomotion. Anterior girdle of cilia is developed close to the base of the proboscis. The posterior girdle is at a distance of one-third of the total length of the animal from the posterior extremity. Micronucleus : band-like, curved into a horse-shoe, lying close to the anterior girdle of cilia. Contractile vacuole postero-terminal. Anal aperture at the posterior extremity close to the position of the contractile vacuole. Greenish or white in colour.

Habitat : Pond water brought along with frogs from near Chauburji.

Didinium balbianii Butschli. (Plate I, fig. 6.)

Specimens of this rare form were met with in the same water from which the other species *D. nasutum* was found. This is characterized by the presence of a single girdle of cilia situated near the base of the proboscis,

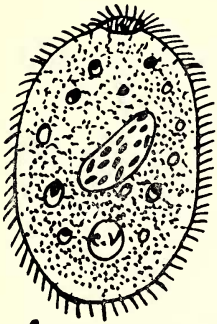


fig 1

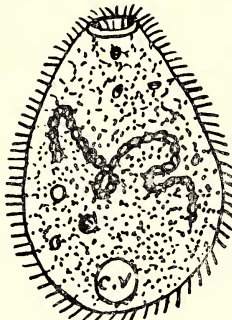


fig 2

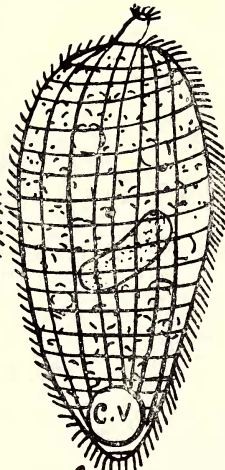


fig 3

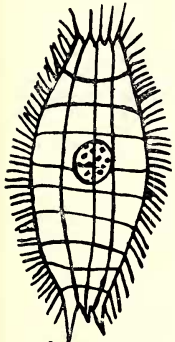


fig 4

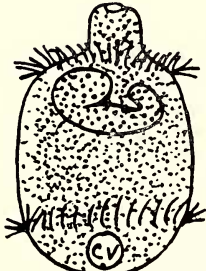


fig 5

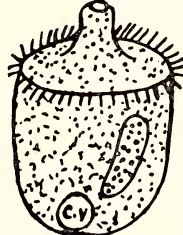


fig 6

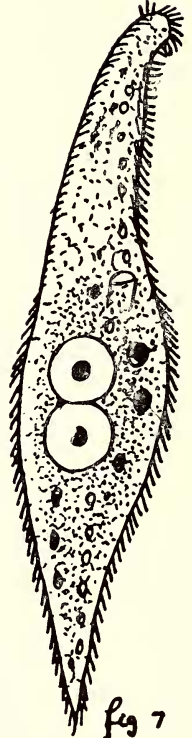


fig 7



fig 8

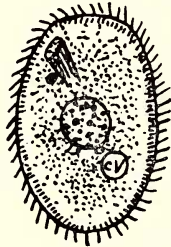


fig 9

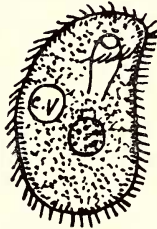


fig 10



fig 11

Macronucleus is seen to lie along the long axis of the body. It is band-like and only slightly curved at the two ends. The contractile vacuole is posteroterminal. Length 50 mic., width 35 mic.

It is conceivable that forms described as *D. balbianii* are only individuals resulting from a transverse division of individuals of *D. nasutum* which have not had time to develop a posterior ciliary girdle. But further observations are regarded essential to establish the specific identity of the two.

Family—*TRACHELINA* Stein.

Genus—*Dileptus* (Dujardin) emend. Wrzeaniowski.

Dileptus gigas (Clap. and Lachm.) Wrzeaniowski.

(Syn. *Vibris anser* O.F. Muller ; *Amphileptus gigas* Clap. and Lachm.).

Plate I, Fig. 7.

Body elongate, lanceolate, pointed posteriorly, the anterior trunk-like appendage equals one half of the total length of the entire body. The body, and the neck showed movements characteristic of the species, locomotion consisting chiefly of swift progression in a straight forward direction, accompanied by rotation of the body on its long axis, the proboscis meanwhile being thrust around in a tentative manner in search of prey. The specimens obtained by me are on an average 150 mic. in length. The cilia covering the body are very fine and close-set, and the neck shows a narrow groove along which the strong adoral cilia are situated. The body does not show any longitudinal striations, but the endoplasm is finely granular. The proboscis is transparent, while the rest of the body appears darker on account of the greater density of endoplasm in that region. Macronucleus consists of two rounded bodies placed side by side. Micronucleus is present and lies near the macronucleus. Pharynx cylindrical, at the top of which the mouth is situated, lies near the base of the proboscis.

Habitat : Found in small pools on the bed of the drying up water-course running through Gol Bagh.

Family—*AMPHILEPTINA* Butschli.

Genus—*Loxophyllum* Dujard.

Loxophyllum meleagris Ehren. (Plate I, fig. 8.)

Free swimming ; flattened ; flexible ; finely and entirely ciliate, lanceolate, the anterior extremity bluntly pointed, and curved, the posterior end is somewhat rounded. Length is to breadth as 5 is to 1. Average length 70 mic., average breadth 14 mic. Locomotion, quiet and gliding. Trichocysts present along one border. Mouth ventrally situated. Contractile vacuole lies near the posterior extremity. Cilia arranged in longitudinal striations on the general body surface. Macronucleus long, cord-like, twisted round itself like a rope.

Habitat : Bottom samples of stagnant water. I obtained only two specimens in the month of October 1923.

This species is being recorded for the first time from India.

Family—*NASSULINA* Butschli.

Genus—*Nassula* Ehren.

Nassula rubens Clap. and Lachm. (Plate I, fig. 9.)

Body 90 X 50 mic., ovate, cylindrical ; flexible ; not polymorphic, equally rounded at the two ends. Evenly ciliate. Brick red, or rose colour. Pharyngeal armature consisting of distinct rod-like teeth ; the tube formed by them is slightly wider anteriorly. Trichocysts are abundant all round. Contractile vacuole is single, subcentral. Macronucleus consists of chromatinic masses within the nuclear membrane. Micronucleus : small, rounded lying near pharyngeal tube. These specimens differ from those described by Kent as regards the ratio between length and width only.

Habitat : Found in pools on the bed of the drying up water-course running through Gol Bagh.

This species is being recorded for the first time in India.

Nassula ambigua Stein. (Plate I, fig. 10.)

Body 80×50 mic., oval; anteriorly deflected a little along an oblique row of cilia; equally rounded at both extremities about one and a half times as long as broad. Evenly ciliate. Pharynx consists of a horny tube dilated anteriorly, and has got no rod apparatus. Contractile vacuole single, spherical, central in position. Macronucleus rounded, micronucleus could not be seen. Beautifully coloured with red and green dots.

Habitat: Pools on the bank of the water-course in the Gol Bagh.

This species is being recorded for the first time from India.

Family--*CHLAMYDODONTA* Stein.Genus--*Chilodon* Ehren.*Chilodon cucullus* Muller. O.F. (Plate I, fig. 11.)

Body 45×28 mic., flattened, persistent in shape, sub-ovate, produced anteriorly into a lamellar, flexible, lip-like prominence, sharply pointed and curved towards the left. Locomotion gliding and undulating. The lip-like projection is obliquely striate; but the general body surface bears cilia along fine longitudinal striations; cilia are close-set and fine. Mouth, in the anterior one-third of the body, is succeeded by a tubular pharynx containing delicate rods. Numerous small vacuoles are distributed in all parts of the body. Macronucleus oval, with one or more big chromatin masses, micronucleus lies close to the macronucleus; contractile vacuoles more than one, and irregularly distributed.

Habitat: Found in large numbers in the month of February 1924, from small pools on the bank of the Chota Ravi.

Sub-order--*HYMENOSTOMATA* Delage.Family--*CHILIFERA* Butschli.Genus--*Glaucoma* Ehren.*Glaucoma scintillans* Ehren. (Plate II, fig. 12.)

Oval in form; persistent in shape, with a convex dorsal and a flattened ventral surface. Oral aperture is situated ventrally towards the anterior extremity, and is associated with a minute vibrating flap-like membrane. The contractile vacuole is posteriorly located. Cilia are evenly distributed all over the body, being disposed in longitudinal striae on the general body surface.

Macronucleus oval, shows a granular structure and lies in the centre of the body. Micronucleus small, rounded, lies on one side of the macronucleus. There are several food vacuoles in the body cavity distributed round the macronucleus in an irregular manner. Length is one and a half times as long as the width. Colour is greenish white.

Habitat: Found from the ditch outside the college laboratory in January 1924.

This species is being recorded for the first time from India.

Genus--*Colpidium* Stein.*Colpidium striatum* Stokes. (Plate II, fig. 13.)

Body 35×17 mic., egg-shaped, anterior end thinner than the posterior; persistent in shape. Mouth near the anterior end with two undulating membranes, one of which is continued down into the gullet. Cilia evenly distributed, arranged in longitudinal rows on the body surface. Length is about twice as long as the breadth. Contractile vacuole single, lies near the posterior end. Macronucleus is a rounded structure with a central big chromatin mass. Micronucleus small, situated a little in front of the centrally located macronucleus.

Habitat: Infusion of dry leaves and hay.

This species is being recorded for the first time from India.

Colpidium campyla Stokes. (Plate II, fig. 14.)

Body ellipsoidal, more elongated than in *C. striatum*, persistent in shape, sharply rounded at the two ends, length is four times as long as the breadth. Cilia are evenly distributed all over the body and are arranged in longitudinal

rows. Mouth as in other members of the genus. Contractile vacuole is single posteroterminal. Macronucleus rounded, lying in the anterior half, near the centre of the body. Micronucleus lies near the contractile vacuole near the posterior extremity. Stained preparation show the micronucleus distinctly. Length 70 mic. width 17 mic.

Habitat : Hay infusion.

This species is being recorded for the first time from India.

Colpidium colpoda Stein. (Plate II, fig. 15.)

Body egg-shaped, anterior end seems to be twisted round the body, mouth followed by a short gullet supporting an undulating membrane which projects out in a tongue-like manner; cilia evenly distributed all over the body, oblique rows of cilia on the general surface. Contractile vacuole is single and posteroterminal. Macronucleus centrally placed shows two big chromatin masses and small particles of chromatin besides. The body is filled up with numerous food vacuoles. The cysts are rounded and burst open to set free at least 4 individuals, when the conditions are favourable. Length twice as much as the breadth, i.e., 70 mic. and 35 mic. respectively.

Habitat : Infusion of dry leaves.

Genus—*Colpoda* Muller.

Colpoda cucullus Ehren. (Plate II, fig. 16.)

Body 46×28 mic., kidney-shaped; not persistent, protoplasm seems to flow into different forms; the anterior end is curved. Length is to breadth as three is to two. Ciliation even, in oblique longitudinal rows on the general body surface. Contractile vacuole single, sub-central. Macro and micro-nuclei both present, situated posteriorly. Locomotion swift.

Habitat : Infusion of hay and dry leaves.

It is very similar to *Colpidium colpoda*, except in its kidney-like form which exhibits changeability.

This species is being recorded for the first time from India.

Family—*UROCENTRINA* Clap and Lach.

Genus—*Urocentrum* Nitzsch.

Urocentrum turbo. Ehren. (Plate II, fig. 17.)

Body 45×32 mic., almost cylindrical; rounded anteriorly and posteriorly. Locomotion quick; darting off like an arrow, with simultaneous rotation on long axis, and showing jerks among changes of direction. Cilia reduced to two bands, one anteriorly and the other posteriorly. The anterior band consists of many rows of cilia. There is a bunch of long cirri at the posterior end. Mouth on the ventral side with a flap-like undulating membrane, leading into a gullet which opens near the contractile vacuole to the out by the side of anus. The contractile vacuole is spherical, and is seem to be formed by the coalescence of four long canals. Macronucleus: horse-shoe shaped, shows a granular structure; micronucleus was not seen.

Habitat : Found in a pond near Data Ganj Bakhsh and in a small pond in Gol Bagh in October and February respectively.

This genus and species is being recorded for the first time from India.

Genus—*Telotrochidium* Kent.

Telotrochidium natthaii sp. nov. (Plate II, fig. 18.)

Animalcules entirely free swimming, ovate, companulate or sub-quadrate, with a round convex anterior margin, and a knob-like projection is protruded asymmetrically on one side of the posterior margin. This knob is retracted and the retracted specimens appear cup-like. Cilia are restricted to two girdles only, each consisting of a single row of cilia all round. The posterior girdle is hidden from view on retraction. Mouth lies about the middle of the body on the ventral side and leads into a ciliated gullet which opens out by the anus situated close to the posterior projection. There are one or some times two contractile vacuoles which lie in the neighbourhood of the mouth. Macronucleus is a long ribbon with numerous karyosome-like bodies. The two extremities are curved up to give it a horse-shoe appearance.

Micronucleus oval or rounded, usually found lying at one of the angles of the macronucleus. The usual ratio between the length and the breadth is as 4 : 3. Fission is always longitudinal, animalcules increase in breadth and ratio of length to breadth becomes 5 : 7. A constriction appears in the hinder region by the formation of an other knob-like projection on the other side. The constriction deepens and the two animals appear as if fused together. The macronucleus is now a straightened ribbon stretching at its full length along the width of the animal. The micronucleus divides but the process of division has not been determined, but probably it is by mitosis as the two halves have been seen to be united by a thin cord. These animalcules go on dividing by binary fission till the size is reduced to one-fourth of the parent form. These appear more or less like the gametes of *Vorticella*. Some of these are rounded and others become elongated, the latter are smaller in size. They do not seem to possess any mouth or anus probably because the process of division becomes rapid and the formation of these organs cannot keep pace with the division rate. The nucleus in these forms has been seen to be oval in form. No micronucleus was seen. Rounded and elongated forms were seen to come together and fuse completely, till the elongated small individual had flown completely into the rounded individuals and was one with it. Nuclear changes of this process could not be observed, because the above-noted stages were encountered in a hanging drop preparation. The individual thus formed had got encysted on the second day. Normal individuals were also seen to encyst in such preparations after two days at the most. The cysts are spherical, with a thick outer coat. There are two or more vacuoles inside each encysted individual. The whole of the protoplasm is seen to rotate in freshly encysted individuals. The structural appearance is granular with a darker granular zone along one margin showing the position of the nucleus. Length 145 mic., breadth 108 mic., greatest breadth in the anterior half in the region of the anterior girdle of cilia.

Habitat : Found in a ditch where dried leaves were rotting.

Specimens were found in great abundance and they were later on grown on Schewiakoff's culture fluid in which they flourished and multiplied in large numbers. At first sight they present a resemblance to detached vorticellæ, but on more intimate acquaintance, they showed resemblance to *Urocentrum* in many respects and so they have been referred to that family group. The organism however differs from the genus *Urocentrum*, in the mode of locomotion ; the character of the ciliary girdles, which are only one row thick as also in the anterior girdle of *Urocentrum*, but the posterior girdle runs obliquely here almost along the posterior border, while it runs transversely in *Urocentrum* about one-third of its length from its posterior end ; mouth is without a flap-like undulating membrane, only one or at the most two or three caudal bristles replace the bunch of caudal cirri found in *Urocentrum*, and also in its mode of binary fission. It shows a good deal of resemblance to a genus *Telotrochidium* discovered by Kent as regards its shape, mode of locomotion, presence of two ciliary girdles only one row thick, and in the longitudinal mode of fission. It however differs from *Telotrochidium* in the following respects :—

(1) The posterior girdle of cilia runs obliquely almost along the posterior border, which runs transversely across the body in *Telotrochidium*, at about one-third of the length of the body from the posterior end.

(2) There is no thick annular border associated with the anterior girdle of cilia, as described in the type species of the genus *Telotrochidium*.

(3) The posterior end is not described as retractile in *Telotrochidium*, while it is so in these animalcules. The organism retracts this posterior end with a jerk recalling the contraction of a vorticellid.

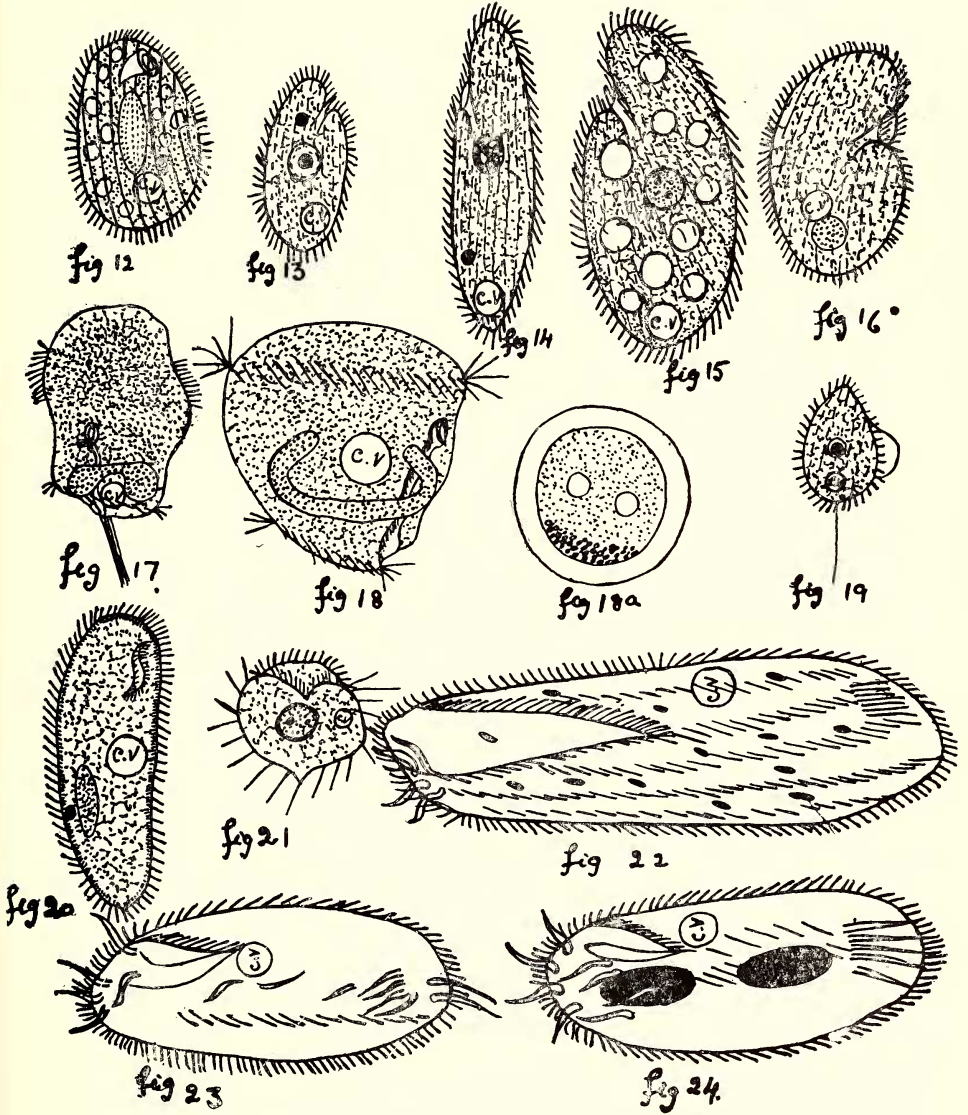
Taking into consideration the above-mentioned points, the specific name *matthaii* is suggested as a small tribute of gratitude to my worthy teacher, Professor George Matthai.

Family—*PLEURONEMINA* Butschli.

Genus—*Cyclidium* Clap. and Lach.

Cyclidium glaucoma Ehren. (Plate II, fig. 19.)

Body 25 × 14 mic., egg-shaped ; broader at the posterior extremity with a long bristle posteriorly. Locomotion very swift, shooting like an arrow,



alternating with standing still. Very quick, changing its directions, often in a jerky manner. The cuticular surface is longitudinally striate, the peristome does not extend much further behind the middle of the body, and the undulating membrane is large, hood-like and extensile. The macronucleus is central and spherical with a karyosome in the centre. The contractile vacuole is situated near the posterior end.

Habitat: Stagnant water in pools on the bank of the Chota Ravi in November.

Family—*CHILIFERA* Butschli.

Genus—*Sigmostomum* Gen. Nov.

Sigmostomum indicum sp. nov. (Plate II, fig. 20.)

Body 145×52 mic., oval, anterior end a little broader than the posterior end. Cylindrical, persistent in shape. Engulfs large filamentous algæ, as big as its own length or even larger. In the latter case the wall of the body gets projected out at a point where the filament pushes it. Often one end of the algal filament is seen projecting out of the mouth opening or the anal opening. Cilia are evenly distributed all over the body. Mouth is situated on the ventral surface in the anterior half of the body, and there is no peristomial field leading to it. There is no gullet. Mouth is an S shaped slit lined by undulating membranes on both the lips. Locomotion swift, restless, rotating round its axis. Contractile vacuole single, spherical, situated near the periphery at about equal distance from either end of the body. Trichocysts studded all round below the outer layers of the ectoplasm. They are shot out on application of various fixatives or even very weak grades of alcohol. Macronucleus is oval in shape, lies in the posterior half of the body and presents a granular structure; these granules seen to be united by a reticulate net-work. Micronucleus small, lying by the side of the macronucleus, is also oval in shape. Length is about three times the breadth.

Habitat: Pond water, surface collections covered over with filamentous algæ. I found it from small temporary collections of water near the fountain pond opposite the Town Hall.

The organism is placed in the family *Chilifera* by virtue of its possessing the following characters:—

1. Absence of peristomial field.
2. Mouth in the anterior half.
3. Gullet scarcely developed.
4. Undulating membranelles at the edge of the mouth.

The organism differs from any of the genera described in this family in the combination of the following characters:—

Mouth not situated at the anterior end, curved in the form of an S and provided with undulating membranelles along with lips, gullet completely absent, posterior end of the body without a caudal cilium. The contractile vacuole in the middle of the body, macronucleus oval, trichocysts well-developed, persistent shape of the body, and the locomotion being always accompanied with rotation on its own axis.

It comes nearest to the genus *Glaucoma* in the combination of the above characters but differs from it by the fact that there is a membranelle all round the margin of the mouth instead of a continued undulating membrane. The macronucleus is oval and the contractile vacuole is situated in the middle of the body.

The name *Sigmostomum* is suggested for this genus and the species is proposed to be called *S. indicum*.

Order—*HETEROTRICHA* Stein.

Family—*HALTERINA* Clap and Lach.

Genus—*Halteria* Dujard.

Halteria grandinella Muller. (Plate II, fig. 21.)

Body 28×28 mic., free swimming animalcules. Form somewhat spherical, usually terminating posteriorly in a somewhat narrower obtusely rounded point; and a small triangular depression at the anterior end associated with a spiral of fine cilia; a zone of long hair-like setæ or springing hairs are developed round